ASSESSING RUNNING ECONOMY BY FOOT CONTACT PARAMETERS AND OXYGEN UPTAKE

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INTRODUCTION

Running economy, which can be evaluated from VO2 consumed in sub-maximal performance, has been shown to be associated with the amount of training and experience in endurance athletes [1, 2]. Both metabolic factors and running technique influences on the running economy [1]. The aim of the present study was to investigate some biomechanical variables in relation to oxygen uptake during treadmill running among skilled runners, skiers and fitness runners.

METHODS

A total of 17 subjects were tested. They were divided in three subgroups according to their training experience. Mean (+SD) age (years), height (cm) and body mass (kg) for the study subgroups were: runners 26+7, 183+3 and 69+5, skiers 27+1, 180+5 and 75+5 and fitness runners 31+4, 181+5 and 78+9, respectively. All the subjects performed an incremental treadmill test at the constant inclination of one degree. The protocol for running speed and time was 8 km/h, 10 km/h, 12 km/h, 14 km/h, 16 km/h, 18 km/h and 20 km/h, 4 minutes or 1 km each, which ever was reached first. Contact times and heel peak pressure were recorded by pressure insoles (Paromed, Germany) and oxygen uptake was measured by respiratory gas analyzer (Oxycon Pro, Germany (1 subject) and Cosmed K4, Italy). Stride length and frequency were calculated by treadmill speed and contact times. Differences between groups were analyzed by student’s t-test and associations between variables by Pearson’s correlation coefficient.

RESULTS

No differences were seen in the stride length and frequency between the groups. Mean VO2max was equal between the runners and skiers as well. The fitness runners had slightly lower mean VO2max compared to other two groups. The most optimal speed evaluated by running economy (kcal/kg/km) for the skilled runners (0.956) and skiers (1.10) was 18 km/h and for the fitness runners (1.13) 14 km/h, respectively. In addition, there was high positive correlations between the contact time and running economy (r=0.80, p<0.01), and between the contact time and heel peak pressure (r=0.76, p<0.01). The heel peak pressure and running economy correlated positively (r=0.62, p<0.05) as well.

CONCLUSION

Running economy in sub-maximal exercise assessed by energy expenditure divided by body mass per kilometer demonstrated better running economy for the skilled runners. Heel peak pressure in our study and previous study by Kyröläinen and colleagues showed to be associated with horizontal force, which can mainly be considered as a braking force in running [1]. This can be explained by improved pre-activation of acting muscles and better utilization of eccentric muscle action preceding powerful horizontal velocity production [1, 2]. In conclusion, this study demonstrated that running economy can be evaluated by the relation between contact time and oxygen uptake in sub-maximal running performance.

REFERENCES


Keywords: Oxygen Consumption, Running, Biomechanics